Unit_1 Functions

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 1**
Length: **5 weeks**
Status: **Published**

Brief Summary of Unit

Students will study the numeric and algebraic relationship between variables. Most relationships of study in this unit have the property that for a given value of the independent variable, there corresponds exactly one value of the dependent variable. Such a relationship is a function. Students will examine the domain, range, intercepts and graphing properties of functions.

Standards

 Diversity and Inclusion: Students will focus on equity, inclusion, and tolerance when analyzing the comparison of various quantities regarding characteristics of people. Equality will also be highlighted which can be associated with both numerical representations through function notation and the connection between people. This can be associated with treating people fairly and equally.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
LA.K-12.NJSLSA.L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
LA.K-12.NJSLSA.L5	Demonstrate understanding of word relationships and nuances in word meanings.
	Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
TEC.K-12.8.1	All students will use computer applications to gather and organize information and to solve problems.
TEC.K-12.8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
WORK.K-12.9.2	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
	Connections to Expressions, Equations, Modeling, and Coordinates.
	The set of inputs to a function is called its domain. We often infer the domain to be all inputs for which the expression defining a function has a value, or for which the function makes sense in a given context.
	In school mathematics, functions usually have numerical inputs and outputs and are often defined by an algebraic expression. For example, the time in hours it takes for a car to drive 100 miles is a function of the car's speed in miles per hour, v; the rule $T(v) = 100/v$ expresses this relationship algebraically and defines a function whose name is T.
	Determining an output value for a particular input involves evaluating an expression; finding inputs that yield a given output involves solving an equation. Questions about when two functions have the same value for the same input lead to equations, whose solutions can be visualized from the intersection of their graphs. Because functions describe relationships between quantities, they are frequently used in modeling. Sometimes functions are defined by a recursive process, which can be displayed effectively using a spreadsheet or other technology.
	Functions presented as expressions can model many important phenomena. Two important families of functions characterized by laws of growth are linear functions, which grow at a constant rate, and exponential functions, which grow at a constant percent rate. Linear functions with a constant term of zero describe proportional relationships.
	A function can be described in various ways, such as by a graph (e.g., the trace of a seismograph); by a verbal rule, as in, "I'll give you a state, you give me the capital city;" by an algebraic expression like $f(x) = a + bx$; or by a recursive rule. The graph of a function is often a useful way of visualizing the relationship of the function models, and manipulating a mathematical expression for a function can throw light on the function's properties.
	Functions describe situations where one quantity determines another. For example, the return on $10,000 invested at an annualized percentage rate of 4.25% is a function of the length of time the money is invested. Because we continually make theories about dependencies between quantities in nature and society, functions are important tools in the construction of mathematical models.

Transfer

Understanding a functions domain and graphical properties can assist students in the fields of science and statistics.

Essential Questions

• Are all equations functions?

• How are the relations between two variables represented in verbal, numeric, graphical, and algebraic form?

• How can functions be applied to mathematical modeling of real world problems?

• What are the defining characteristics and representations of a function?

Essential Understandings

• a function models a relationship between two variables

• a graph may cross a horizontal asymptote but never a vertical asymptote

• not all functions have inverse functions

• the domain of a function is the set of all independent values for which the function is defined.

• there is an algebraic and graphical relationship between a function and its inverse.

• to be a function every value of the independent variable may only correspond to one value of the dependent variable.

Students Will Know

• How horizontal and vertical asymptote effect the graph of a function.

• How to build new functions from existing functions.

• How to construct and compare linear, quadratic, and exponential models.

• How to graph a piece-wise function.

• How to graph and find the equation of an inverse function.

• How to identify the domain and range of a function.

• How to present solutions in interval notation and inequality notation.

• How to represent a function by equations, graphs and tables of values.

• How transformation of graphs: shifts and stretches (both horizontally and vertically) affect the picture of a graph and the equation of a function.

• The difference between a dependent and independent variable.

Students Will Be Skilled At

• Building new functions from existing functions (composite functions)

• Comparing properties of polynomial, rational and exponential models.

• Constructing polynomial, rational, and exponential models.

• Determining the difference between a dependent and independent variable.

- Finding the equation of an inverse function

- Finding the equations of any horizontal or vertical asymptotes

- Graphing a piece-wise functions.

- Graphing an inverse function.

- Identifying the domain of a function: classifying the undefined values of a function.

- Using the domain of a function to identify the range of the function.

- Writing solutions in interval notation and inequality notation.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments

- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments

- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math

- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Answer essential questions

- Class discussion of daily topic

- Classwork and homework that assess the essential questions

- Provide alternative means of assessments for certain students

- Students will be able to determine the reasonableness of a solution and provide verbal/written explanation for the validity of their solution.

- Students will demonstrate their understanding of functions by analyzing functions both algebraically and graphically.

- Students will have the knowledge and skill to compare and contrast the graphs of a function; specifically the zeros, maximum, minimum values of the function.

- Students will interpret expressions for functions in terms of the situation they model.

- Students will use technology (TI graphing calculator) to solve problems, interpret results and verify conclusions

- Teacher Observation

- Tests and quizzes that assess the essential questions

- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

- Algebra II Review of factoring and simplifying rational expressions.

- Find intercepts of graphs (real zeros of a function). Review synthetic division and rational root theorem.

- Find the domain algebraically for all functions.

- Find the range of functions by algebraic and graphical means.

- Graph functions – polynomial, rational, radicals, log and exponential.

- Inverse functions

- Mathematical Models: building functions

- Review properties of a linear function – slope, intercepts, parallel and perpendicular lines using graphing calculators and online activities

Materials

Core Book List including AP Calculus Larson 12E

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook
- Khan Academy
- Teacher created activiites
- Teacher created notes

Suggested Strategies for Modifications

Possible accommodations/modification for CP Calculus